

A New Fossil *Cypraea* (Gastropoda: Prosobranchia) from Southern Africa with Notes on the Alexandria Formation

by

WILLIAM R. LILTVED

Department of Invertebrate Zoology, California Academy of Sciences, Golden Gate Park,
San Francisco, California 94118, U.S.A.

AND

F. G. LE ROUX

Geological Survey, P.O. Box 1774, Port Elizabeth 6000, South Africa

Abstract. A new extinct species of *Cypraea*, *C. zietsmani*, is described from the Neogene of the Alexandria Formation from the eastern Cape Province of South Africa. It is compared with allied Recent and fossil taxa. The depositional environments and associated fauna are described.

INTRODUCTION

In June 1981, Ross Zietsman, of the Port Elizabeth City Engineers Department, collected a number of fossil gastropod and bivalve shells while excavating in the Neogene Alexandria Formation near Port Elizabeth, in the eastern Cape Province of South Africa. The collection included an undescribed species of *Cypraea*. Additional specimens pertaining to the new species were collected by the South African Geological Survey, during further investigation of the Alexandria Formation in 1985 and 1986. This paper describes the aforementioned taxon and gives a generalized summary of the Alexandria Formation and fauna associated with it.

DESCRIPTION

Cypraea zietsmani Liltved & Le Roux, sp. nov.

(Figures 1-3, 5 in part)

Shell large, 56-66 mm in length, depressed, pyriform. Margins broad, angularly rounded, corrugate, especially posteriorly, and deeply cut by wide posterior notch. Dorsal surface bears two heavily calcified tubercles in posterior one-third of shell, one on either side of medio-dorsal line. Less eroded shells possess a short dorsal sulcus between

raised thickened ridges immediately adjacent to the medio-dorsal line. Sulcus situated on pronounced dorsal hump at one-third anteriorly. Hump slopes abruptly toward produced anterior terminal. Base heavily thickened, flattened, with distinct depression along columellar peristome. Margins reflected on either side, extending beyond lateral plane of body whorl in mature individuals. Aperture moderately narrow, slightly curved, constricted posteriorly by funicular callus. Medial portion of aperture evenly wide, becoming dilated anteriorly. Columellar peristome poorly defined owing to concave basal depression, edentate for most of its length, except for up to five coarse, uneven, rounded teeth situated above the fossula. Fossula flared, concave, edentate, with prominent terminal ridge extending concavely upward into flattened columellar flange, which borders the anterior siphonal canal. Labrum broad, widest posteriorly, becoming narrower anteriorly, with 15 to 20 coarse, evenly spaced, rounded teeth present along inner edge. Teeth extend as raised ridges to two-thirds of labral width. The type specimens are predominantly chalky white and lack any color. Under ultraviolet light, however, the raised transverse labral ridges are pigmented and the columellar portion of the base shows transverse bands and spots (Figure 3). Pigment spots are present on the margins within recessed portions of the posterior corrugations, and wide zig-zag markings are present anteriorly.

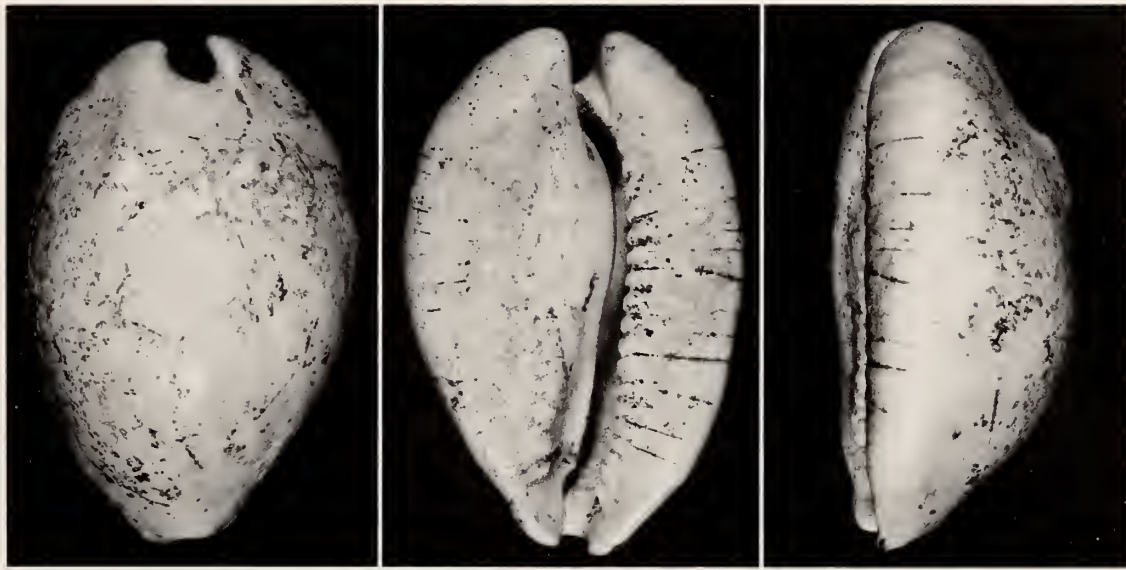


Figure 1

Cypraea zietsmani Liltved & Le Roux, sp. nov. Holotype shell, 58.6 mm long. Left, dorsal; middle, ventral; and right, lateral aspects.

Measurements:

	<u>Length</u> (mm)	<u>Width</u> (mm)	<u>Height</u> (mm)
Holotype (SAM-PQ 2573)	58.6	38.5	26.4
Paratype F (SAM-PQ 2574)	65.8	50.4	30.9
Paratype H (SAM-PQ 2575)	63.8	46.6	28.6
Paratype G (CASG- 61612.01)	62.7	48.8	28.8
Paratype A (LR 263)	56.8	39.9	26.5
Paratype B (LR 270)	56.0	45.0	27.9
Paratype C (LR 265)	60.8	47.1	30.9
Paratype D (LR 271)	58.0	46.1	27.4
Paratype E (LR 267)	59.8	49.5	28.9

Type locality: Aloes Siding, 15 km north of Port Elizabeth (33°48'56"S, 25°37'49"E), eastern Cape Province, South Africa, Pliocene, Alexandria Formation, 44 m elevation, pebbly calcareous sandstone.

Type deposition: The holotype (SAM-PQ 2573), and two paratypes (SAM-PQ 2574, 2575) have been deposited in the South African Museum. The three aforementioned specimens were collected at the type locality by Ross Zietsman in June 1981. Five paratypes (LR 263, 265, 267, 270, 271) have been deposited in the collection of the Geological Survey, South Africa. These five paratypes were collected by the Geological Survey at St. George's Strand north of Port Elizabeth, in 1985 and 1986. One paratype (CASG-61612.01) has been deposited in the California Academy of Sciences. This specimen was collected at the type locality by Ross Zietsman in June 1981.

Discussion: *Cypraea zietsmani* sp. nov. conchologically most closely resembles the Recent species *C. fultoni* Sowerby, 1903, which occurs at depths exceeding 65 m off the coast of Natal, South Africa. The major difference in shell morphology between the two is that *C. zietsmani* invariably lacks the columellar dentition of *C. fultoni*. *Cypraea zietsmani* may possess up to five rounded teeth along the anteriormost portion of the columellar peristome immediately above the fossula, but otherwise is edentate. The columellar peristome of *C. zietsmani* is poorly defined owing to the innermost portion of the columellar basal area being recessed and relatively thin, whereas that of *C. fultoni* is heavily callused with a well-defined, toothed columellar peristome. All examined specimens of *C. zietsmani* possessed two pronounced, posteriorly situated dorsal tubercles. Some of the less eroded shells displayed a clear, short dorsal sulcus, situated anteriorly, between thickened ridges, immediately on either side of the medio-

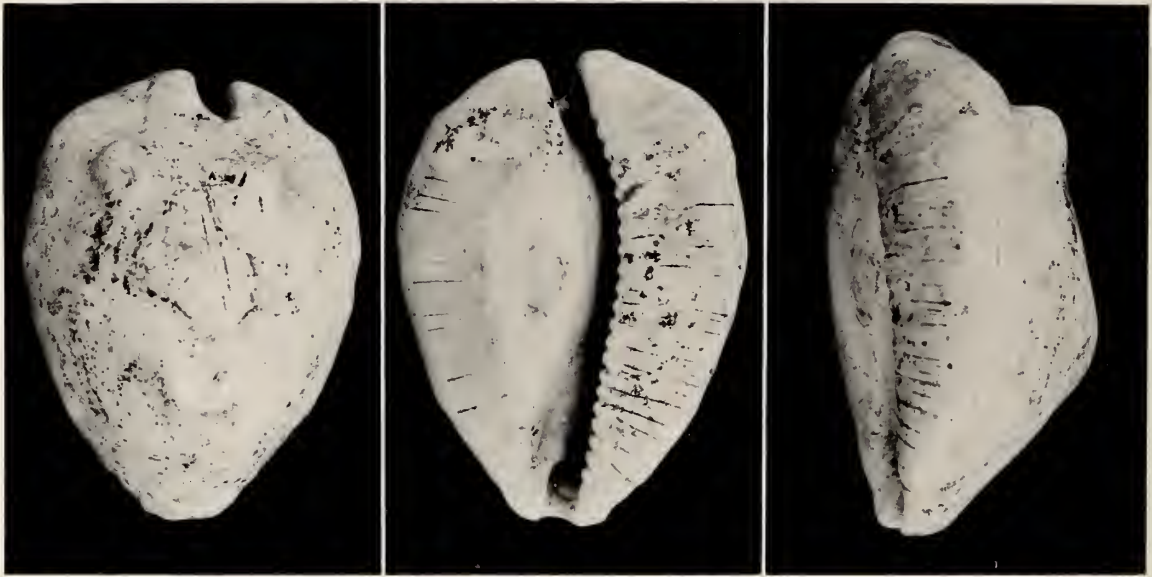


Figure 2

Cypraea zietsmani. Shell from collection of Mrs. F. Ball, 60.5 mm long. Left, dorsal; middle, ventral; and right, lateral aspects.

dorsal line. Neither of these characters is present in *C. fultoni*. However, similar tubercules may be seen on the shells of extinct and extant congeners. *Cypraea mus* Linné, 1759, a living shallow-water species from Venezuela and Colombia, and ancestral species belonging to the *C. henekeni* Sowerby, 1850, complex (INGRAM 1947, 1948) from the Mio-Pliocene of South and Central America, exhibit similar dorsal tuberculations to those found on shells of *C. zietsmani*. *Cypraea teulerei* Cazenavette, 1845, a recent, shallow-water species from the Gulf of Oman is also conchologically similar to *C. fultoni* and *C. zietsmani*, but is virtually edentate and lacks any vestige of dorsal tuberculations. The three extant relic species, *C. fultoni*, *C. mus*, and *C. teulerei*, extinct species such as *C. zietsmani*, and members of the *C. henekeni* complex (*C. andersoni* Ingram, 1947, *C. caroniensis* Maury, 1927, *C. cayapa* Pilsbry & Olsson, 1941, *C. grahami* Ingram, 1947, *C. henekeni* Sowerby, 1850, *C. isthmica* (Schilder, 1927), *C. merriami* Ingram, 1939, *C. nouelei* Maury, 1917, *C. projecta* Ingram, 1947, *C. quagga* (Schilder, 1939), *C. rugosa* Ingram, 1947, and *C. tuberae* Ingram, 1948) appear to be related. All of these species are characterized by being somewhat squat with a pronounced dorsal hump situated in the posterior one-third of the shell. The bases are typically flat and broad with centrally placed apertures. The margins are deeply cut posteriorly by a wide notch. The fossula terminates in a well-formed terminal ridge, and is normally devoid of denticles. Recent species are characterized by having a rather amorphous dorsal color pattern. Well preserved fossil material viewed under ultraviolet light shows remnants of a similar pattern.

PETUCH (1979) placed *Cypraea mus* and the *C. henekeni* complex in *Syphocypraea* Heilprin, 1887, on the basis of similar conchological morphology in the bulla stages of *C. mus*, *C. henekeni*, and *Cypraea* (*Syphocypraea*) *problematica* Heilprin, 1887, the type species of the genus. We place the members of the *C. henekeni* complex merely in *Cypraea*, not *Syphocypraea*, on the grounds that members of *Syphocypraea* possess a spiriform posterior canal and not the deeply cut posterior notch present within the *C. henekeni* complex. Shells of *S. problematica* have an elongate, ovoid shell, whereas those of the *C. henekeni* complex and *C. mus* tend to be more anteroposteriorly compressed, angular in

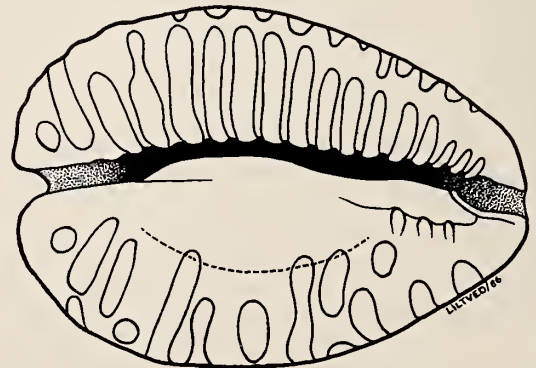


Figure 3

Cypraea zietsmani. Paratype A shell, 56.8 mm long. Ventral aspect showing pigmented areas when exposed to ultraviolet light.

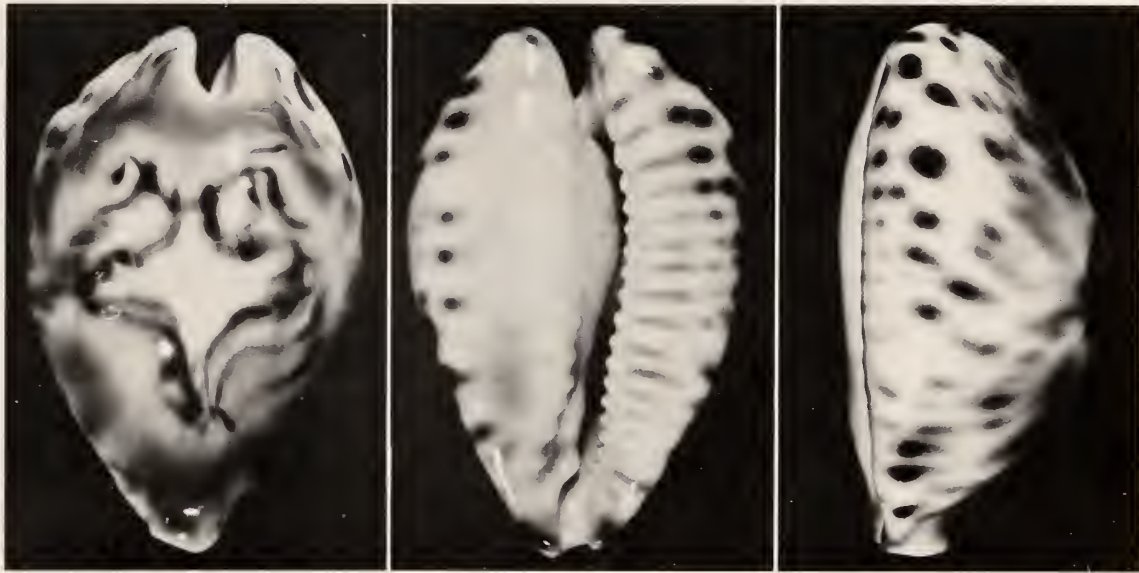


Figure 4

Cypraea fultoni Sowerby, 1903. Shell, 58.4 mm long. Left, dorsal; middle, ventral; and right, lateral aspects.

shape with an elevated dorsal hump. Based on conchological similarity, the affinities of the *C. henekeni*-*C. mus* complex appear to be with species placed in the *Cypraea* subgenus *Barycypraea* Schilder, 1927, which include *C. fultoni*, *C. teuleri*, and *C. zietsmani*, rather than with *Syphocypraea*.

One paratype of *Cypraea zietsmani* (Figure 5, in part) shows evidence of having been preyed upon by a molluscivorous fish. Shells of *C. fultoni* Sowerby, 1903 (Figure 4) and *C. broderipii* Sowerby, 1832 (Figure 5, in part), which are occasionally taken from stomachs of the musselcracker, *Cymatoceps nasutus* (Castelnau, 1861), caught

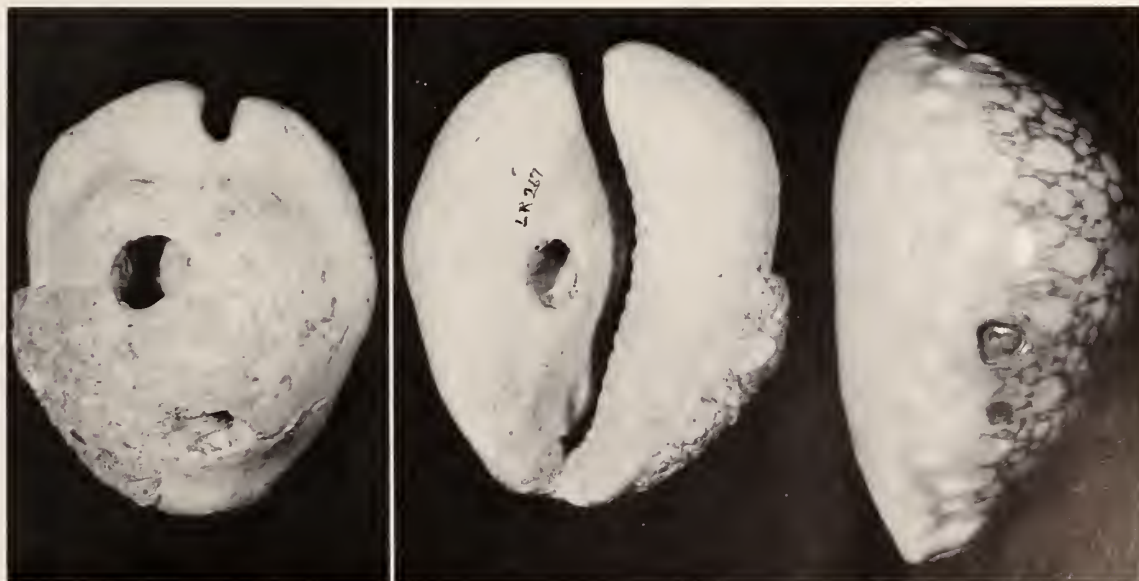


Figure 5

Left (dorsal) and middle (ventral): *Cypraea zietsmani*, paratype E, 59.8 mm long, showing perforations caused by fish predation. Right, lateral: *Cypraea broderipii* Sowerby, 1832, 74.1 mm long, showing partially healed perforations due to predation by *Cymatoceps nasutus* (Castelnau, 1861).

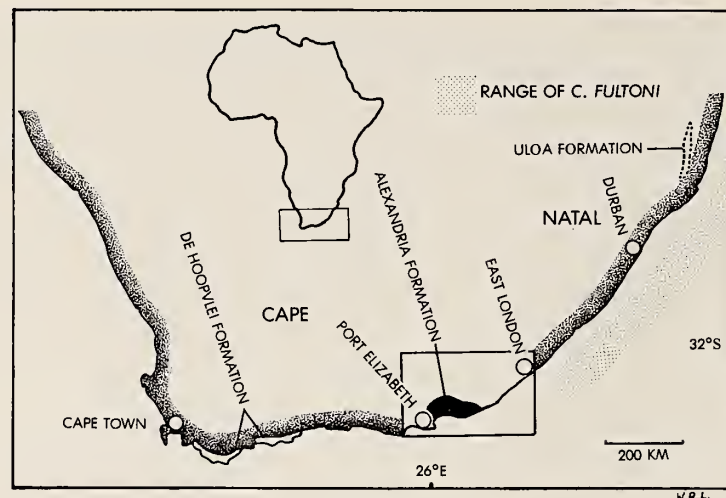


Figure 6

Index map showing areal extent of Alexandria Formation and its possible correlatives—the De Hoopvlei and Uloa formations. The range of *Cypraea fultoni* Sowerby, 1903, is shown by the shaded area. The area enclosed within the rectangle is shown in detail in Figure 7.

in deep water off Natal, occasionally bear round or ovoid perforations punched out by the powerful, toothed jaws. The holes are similar to those on the base and dorsum of paratype E. The interior of paratype F indicates that after death, the shell became the habitat of a bryozoan colony. The characteristically bored holes on the base of paratype H indicate that the shell became riddled by a clonid sponge after death.

Etymology: The new species is named for Ross Zietsman of Port Elizabeth, South Africa, who collected the holotype and provided some of the type material used in this study.

PALEOECOLOGY

The Alexandria Formation represents a marine deposit of Neogene age. It unconformably overlies the Mesozoic Uitenhage Group or the Paleozoic Cape Supergroup as a veneer on a well-planed, dissected, and stepped seaward-sloping platform. Discontinuous outcrops of the formation occupy a narrow strip 20 to 40 km wide, between the Elands and Suur mountains in the south and the sea. The westernmost outcrop of the Alexandria formation is marked by an erosional cut-off in the vicinity of the Gamtoos River, while the eastern boundary is defined by the Kowie River (Figure 7). The northern limit of the formation roughly coincides with the 300-m contour, while southward it may pass below sea level onto the continental shelf, although it would seem more probable that post-Tertiary (marine) erosion has removed all but remnants of the Alexandria Formation in the offshore. The type area of the formation is situated east of the Sundays River in the vicinity of Colchester (LE ROUX, in press b).

The age of the Alexandria Formation, as indicated by molluscan as well as foraminiferal assemblages, is Neogene (SIESSER & DINGLE, 1981), with stratification generally becoming more recent seawardly.

The formation consists essentially of alternating beds of whitish gray, fine to medium-grained, calcareous sandstone, subordinate shelly conglomerate and coquinite that contain rich assemblages of marine invertebrates (LE ROUX, in press a). The formation is normally between 3 and 9 m thick. Sedimentary structures, corroborated by biogenic structures, fossil assemblages, and the physical condition of the shells, point to depositional environments ranging from shoreface and foreshore to lagoonal and/or estuarine.

The Alexandria Formation is correlated with the De Hoopvlei and Uloa formations (both Neogene) in the southwestern Cape Province and Natal (LE ROUX, in press b), chiefly owing to lithological, paleontological and chronostratigraphical similarities (Figure 6).

Distribution and inferred habitat: Shells of *Cypraea zietsmani* were found at five localities on the lowest of three terraces. This terrace is tentatively regarded as being of Pliocene age.

(a) Aloes Siding (44 m elevation) northeast of Port Elizabeth (33°48'56"S, 25°37'49"E). At the type locality, specimens of *Cypraea zietsmani* were found in a trench, which has since been closed. The depositional environment, as inferred from outcrops in the immediate vicinity, is that of a beach. The locality is situated on one of a number of beach ridges that parallel the present-day shoreline. These beach ridges are taken to represent paleo-shorelines of a regressing sea during the Pliocene. Fossils at this locality

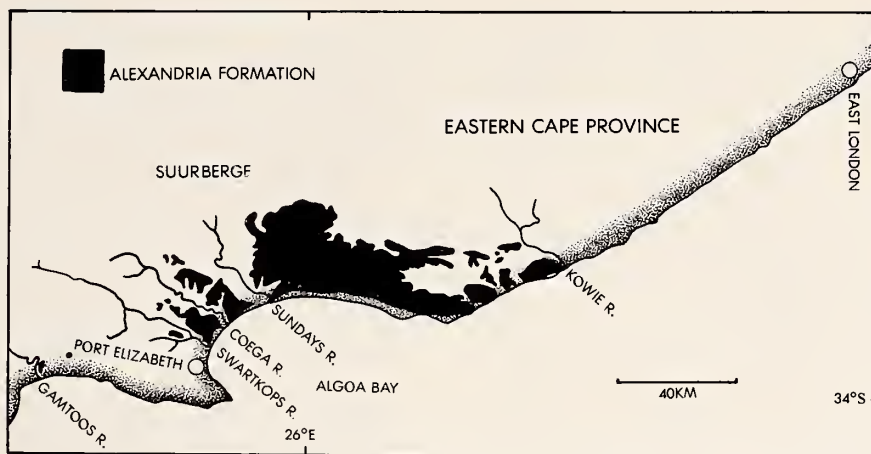


Figure 7

Distribution of Alexandria Formation (most of the formation is unexposed) (after LE ROUX, in press b).

are rare owing to poor exposures, but shells of +*Glycymeris borgesii* (Cox, 1946), +*Melapium patersonae* Newton, 1913, *Marginella* sp., and *Conus* sp. were found on the surface.

(b) St. George's Strand (39 m elevation) northeast of Port Elizabeth, 33°49'22"S, 25°39'12"E). A foreshore (beach) depositional environment is inferred for the sequence exposed at this locality. Thin pebble-cobble beds alternate with coquina layers. A thin semiconsolidated sandstone bed yielded several *in situ* *Bullia digitalis* (Dillwyn, 1817) which are typical of a sandy beach environment. Fossils at this locality include the following (+ = extinct taxa).

Inferred habitat preference

Gastropoda	
<i>Amalda optima</i> (Sowerby, 1892)	subtidal sand
<i>Amalda obtusa</i> (Swainson, 1825)	subtidal sand
<i>Bullia digitalis</i> (Dillwyn, 1817)	intertidal sandy beach
<i>Conus</i> sp.	reef/sand
<i>Fusinus ocelliferus</i> (Lamarck, 1816)	intertidal/subtidal, reef/sand
<i>Heliacus</i> cf. <i>trochoides</i> (Deshayes, 1830)	intertidal/subtidal, rocky shore
+ <i>Pseudoliva</i> sp. nov. ?	sand
<i>Siphonaria aspera</i> Krauss, 1848	intertidal rocky shore
<i>Thais capensis</i> (Petit, 1852)	low neap tide downwards reef
<i>Thais haemostoma</i> (Linné, 1767)	intertidal/subtidal reef

<i>Turritella carinifera</i> Lamarck, 1822	intertidal/subtidal reef
+ <i>Vasum</i> sp. nov. ?	subtidal reef
Bivalvia	
<i>Crassatina capensis</i> (Lamy, 1917)	subtidal sand
+ <i>Glycymeris borgesii</i> (Cox, 1946)	subtidal sand
+ <i>Notocallista schwarzi</i> (Newton, 1913)	subtidal sand
<i>Perna perna</i> (Linné, 1758)	intertidal/subtidal, rocky shore

(c) Coega (60 m elevation) northeast of Port Elizabeth (33°45'04"S, 25°40'06"E). Two *Cypraea zietsmani* specimens were found in a coquinite layer that had been deposited as a beach berm. The high wave energy that existed during the deposition of this shelly layer is suggested by the fragmented and worn nature of the fossil shells. Both specimens are worn and filled with comminuted shell fragments. Other fossils from this coquinite are the following.

Inferred habitat preference

Gastropoda	
<i>Bullia digitalis</i> (Dillwyn, 1817)	intertidal sandy beach
<i>Siliquaria</i> cf. <i>wilmanae</i> (Tomlin, 1918)	subtidal rock
Bivalvia	
<i>Arca noae</i> (Linné, 1758)	subtidal reef
<i>Barbatia foliata</i> (Forsskål, 1775)	intertidal rocky shore
+ <i>Cardium edgari</i> Newton, 1913	sand

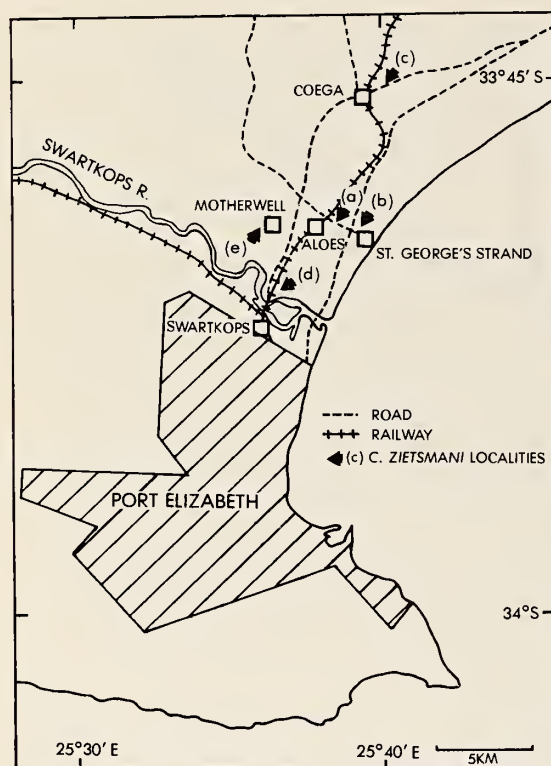


Figure 8

Localities of *Cypraea zietsmani*.

<i>Donax serra</i> Dillwyn, 1817	intertidal sandy beach
+ <i>Glycymeris borgesii</i> (Cox, 1946)	sand
<i>Isognomon</i> sp.	reef
<i>Ostrea algoensis</i> Sowerby, 1871	intertidal/estuarine rock
+ <i>Pinctada</i> sp. nov. ?	reef
<i>Scissodesma spengleri</i> (Linné, 1767)	intertidal/subtidal sand
Anthozoa	
<i>Balanophyllia</i> sp.	reef
Echinoidea	
<i>Echinodiscus</i> sp.	lower intertidal to subtidal sand

(d) Railway cut 1 km north of Swartkops (43 m elevation) Port Elizabeth (33°50'15"S, 25°36'44"E). *Cypraea zietsmani* specimens were found in a fossiliferous, semi-consolidated conglomerate layer showing typical low-angle beach stratification as well as imbrication. A sandstone lens in this unit shows herringbone cross-bedding, which is also suggestive of a beach environment. The generally good physical condition of shells in this layer suggests only moderate wave energy during deposition. Fossils associated with *C. zietsmani* at this locality are the following.

	<u>Inferred habitat preference</u>
Brachiopoda	
<i>Kraussina</i> sp.	reef
Gastropoda	
<i>Dendrofissurella scutellum</i> (Gmelin, 1791)	intertidal rocky shore
+ <i>Calyptrea kilburni</i> Kensley and Pether, 1986	reef
+ <i>Clionella</i> sp. nov. ?	sandy reef
<i>Diodora elevata</i> (Dunker, 1846)	subtidal reef
<i>Fissurellidea aperta</i> (Sowerby, 1825)	intertidal/subtidal reef
<i>Melapium elatum</i> (Schubert and Wagner, 1829)	subtidal sand
<i>Nucella squamosa</i> (Lamarck, 1816)	subtidal reef
<i>Turritella sanguinea</i> Reeve, 1849	subtidal sand
+ <i>Vasum</i> sp. nov. ?	subtidal reef
Bivalvia	
<i>Barbatia obliquata</i> (Gray, 1837)	intertidal rocky shore
+ <i>Glycymeris borgesii</i> (Cox, 1946)	subtidal sand
<i>G. cf. queketti</i> (Sowerby, 1897)	subtidal
+ <i>Pinctada</i> sp. nov. ?	subtidal reef
Scaphopoda	
<i>Dentalium</i> sp.	subtidal sand
	<u>Inferred habitat preference</u>
(e) Trench at Motherwell, 3 km north of Swartkops (58 m elevation), Port Elizabeth (33°47'50"S, 25°36'22"E). Two specimens of <i>Cypraea zietsmani</i> were found in a fossiliferous pebbly coquinite, deposited as a beach berm. High wave energy during deposition is suggested by the fragmented nature of the shells. Fossils associated with this coquinite are the following.	
Gastropoda	
<i>Bullia annulata</i> (Lamarck, 1816)	subtidal sand
<i>Melapium elatum</i> (Schubert & Wagner, 1829)	subtidal sand
Bivalvia	
<i>Ostrea atherstonei</i> Newton, 1913	subtidal reef
<i>Isognomon cf. gaudi-chaudi</i> (d'Orbigny, 1842)	intertidal/subtidal reef

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